

 CARLO GAVAZZI SPACE SpA	<h1>AMS02-PDS</h1>	N° Doc: PDS-RP-CGS-120 Doc N°:	
	PDS-PFM THERMAL VACUUM TEST REPORT	Ediz.: 1 Issue:	Data: SEPT 2009 Date:
		Pagina 27 Page	di 29 of

ANNEX 1: FACILITY TEST REPORT

<p>SERMS</p> <p>Laboratorio per lo Studio degli Effetti delle Radiazioni sui Materiali per lo Spazio</p> <p>Via Pentima Bassa, 21 Terni 05100 TR phone/fax: +39.0744.49.29.13</p>	<p>ENVIRONMENTAL TEST REPORT</p>	<p>doc: PDS TVT date: 07/09/09 rev: A02 pag: 1 /39 file: ENVRPT149_S2413R-A02-07SEP2K9</p>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------	------------------------------------------------------------------------------------------------------------

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

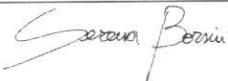
ENVIRONMENTAL TEST REPORT

ENVRPT149_S2413R-A02-07SEP2K9

date: September 07, 2009

Prot.: 011-09/SERMS

signature

test report prepared by:	07/09/09	Ing. S. Borsini	
		<i>Test Engineer</i>	
test report controlled by:	07/09/09	Ing. Stefano Lucidi	
		<i>QA manager</i>	
approved by:	07/09/09	Prof.ssa. B. Bertucci	
		<i>Test Responsible</i>	

change record

date	change description	revision
07/09/2009	first issue	A01
16/09/2009	Approved version with few changes	A02

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 2 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

NOTICE



REPRODUCTION OF THIS REPORT

Reproduction or duplication of any portion of this report is expressly forbidden, except by those contractors receiving it directly from authorized data interchange offices or the originator, for their internal use or the use of their subcontractors. Reproduction or display of all or any portion of this material for any sales, advertising or publicity purposes is prohibited.



TEST REPORT DESCRIPTION

This document is generated by the S.E.R.M.S. Laboratory and reports on the setup, the operation and the results of the test performed on the customer Device Under Test (D.U.T.); several sections compose this report: all of them have been integrated and adapted to the specific tests performed on the D.U.T.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 3 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

CONTENTS

GENERAL INFORMATION.....	4
APPLICABLE LAWS AND RULES.....	5
SERMS FACILITY - QUALITY ASSURANCE INFORMATION	6
TEST SUMMARY	7
TEST RESULTS.....	8
REMARKS	8
TEST DIARY.....	10
TEST SET-UP	10
UNPACKAGE AND POSITIONING.....	10
THERMAL SENSORS POSITIONING IN THE TVC	14
THERMAL SENSORS POSITIONING ON THE PDS.....	15
CABLING AND MLI POSITIONING	24
TEST GRAPHS	26

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 4 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

GENERAL INFORMATION

Job Number:

S2413R

Test performed on:

The AMS-02 Power Distribution System Flight Model (PDS-PFM)

Contractor:

Carlo Gavazzi Space
Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

Contractor responsible:

M.Olivier (Carlo Gavazzi Space)

Test responsible:

Two different subjects - Carlo Gavazzi Space s.p.a and S.E.R.M.S.- have participated to this test. Roles and responsibilities of the participating subjects are fully defined in the customer procedure **PDS-PR-CGS-012**.

In particular :

- Test conduction has been responsibility of CGS. CGS personnel units at SERMS have contributed to the setup and disassembly phases, verifying thermal sensor locations and failure. They regularly monitored the test execution and issued test procedure variations.
- PDS switch-on/switch-off operations, monitoring and functional tests have been performed by CGS personnel units. Recorded data from PDS functional test are under responsibility of CGS.
- SERMS has been responsible for the test facility and the measurement hardware (thermal vacuum chamber, thermal sensors, pressure sensors, data acquisition chain).
- SERMS has been responsible of the environmental parameters and PDS temperature measurements along the whole test. Recorded data have been handled only by SERMS qualified personnel.

The SERMS project manager responsible for the test has been Prof.ssa Bruna Bertucci.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 5 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

APPLICABLE LAWS AND RULES

CUSTOMER TEST PROCEDURE

PDS-PFM THERMAL VACUUM TEST PROCEDURE
PDS-PR-CGS-012, issue 2, 16/07/2009 and subsequent PVSS

S.E.R.M.S Lab. - INTERNAL TEST PROCEDURE
09-PT-TVM-A01-26APR2K6.doc
THERMOVACUUM TEST PROCEDURE

D.L. 19 settembre 1994, n.626

Attuazione delle direttive 89/391/CEE, 89/654/CEE, 89/655/CEE, 89/656/CEE, 90/269/CEE, 90/270/CEE, 90/394/CEE e 90/679/CEE riguardanti il miglioramento della sicurezza e della salute dei lavoratori sul luogo di lavoro, e successive modifiche;

MIL-HDBK-831 23 April 1999

Preparation of Test Reports (guidance only);

UNI -10653 - November 1997

Quality product technical documentation (guidance only) ;

UNI CEI EN45001

general criterion for test laboratory operation;

UNI CEI 70001

norm certificate test laboratory terms and definitions;

UNI CEI 70011

guide for test result presentation;

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 6 /39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

SERMS FACILITY - QUALITY ASSURANCE INFORMATION

EQUIPMENT	MANUFACTURER	P/N	S/N	ACCURACY	NEXT CAL DATE	REMARKS
TV chamber with pressure measurement and temperature acquisition system	Angelantoni	HVT-2000 MC	10107	NA	Conformance certificate (first installation) is dated 12/01/2006	Detailed technical informations have been provided by the Facility.
THERMAL RIBBONS	MINCO	S651		Class B tolerance	January 2010	Sensors utilized to control the chamber
DAQ	NATIONAL INSTRUMENTS	6036E	11DAA16	INPUT 16 bit 200kS/sec ±0,05 to ± 10 V	December 2009	none

TEST SUMMARY

The actual procedure adopted in the test is schematically presented in figure 1.

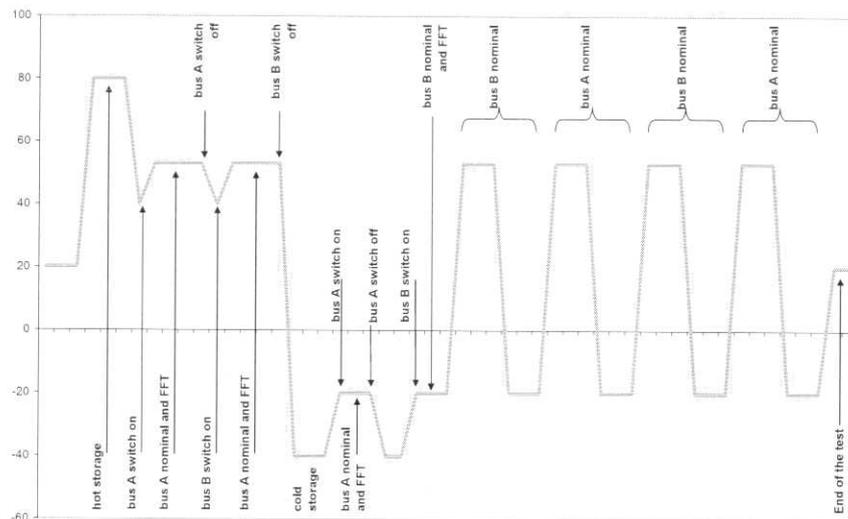


FIGURE 1 – TEST TEMPERATURE PROFILE.

Hot storage	+80°C
Hot operative	+53°C
Cold storage	-40°C
Cold operative	-25°C

It derives from:

1. the approved reference profile on the customer procedure: PDS-PR-CGS-012 is.2 and the related PVS;
2. Subsequence modifications, as per the PVS generated during the test, have modified the profile according to the final layout which can be found in figure 27 (PDS TRP TEMPERATURE PROFILE)

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 8 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

TEST RESULTS

The PDS-PFM flight model has been tested at S.E.R.M.S. in the Thermal Vacuum Chamber (TVC) during the period August 26th – September 3th 2009.

The test has been performed according to the test profile shown in the previous section of this report under the continuous conduction of a customer representative (CGS). PDS experts from CGS have attended the test and operated the PDS during the switch-on/switch-off and functional test phases.

A discrepancy between the temperature measurements readout by the National Instrument (NI) Data Acquisition System and the values read out by the TV chamber data acquisition software (WINKRATOS) has been observed during the first stabilization phases of the test (with the PDS switched off) at 80°C and 53°C (cfr. Remark #1). Nevertheless the environmental parameters in the TVC matched the customer requests and were continuously recorded.

The PDS temperatures have been continuously monitored in 31 locations and their values recorded during the whole test period (cfr. Remark #2). The complete set of recorded data can be provided on customer request. In this report will be summarized only the most significant test data.

All the commitments of S.E.R.M.S. with the customer have been fulfilled and the test can be declared successfully completed for what concerns the items under S.E.R.M.S. responsibility.

REMARKS

REMARK #1

A discrepancy between the temperature measurements readout by the National Instrument (NI) Data Acquisition System and the values read out by the TV chamber data acquisition software (WINKRATOS) has been observed during the stabilization phases of the test (with the PDS switched off) at 80°C and 53°C. During the stabilization phase, approaching to the thermal equilibrium, the TRP 06, 07, 08 and 09 (placed on PDS lateral wall) and the chamber sensors ch8 which are placed on the cold plate to which the PDS is connected showed an offset that depends on the environmental temperature: a difference of 3,5°C was found at 80°C and a difference of 3,1°C was found at 50°C.

A detailed analysis of the possible calibration/readout problems affecting the temperature readings of the chamber and NI thermal sensors was performed to verify the source of the observed discrepancy and two different causes were found to contribute:

- 1) *Wrong Resistance to Temperature conversion factors in the VI software managing the NI acquisition system.*
- 2) *Calibration constants of the chamber thermal measurements.*

The combined effect of these two factors can justify the offset in the temperature values experimented during the stabilization phases. Applying the right a, b and c constants to convert resistance into temperature value and considering the calibration curve of the chamber sensors, the offset between the PDS TRP and the chamber PT100 has been evaluated. During the stabilization phases, with the PDS switched off, the offset was estimated to be lower than 1°C (for details see the NCR *NC11-27AGO2K9-r3.pdf*).

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 9 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

At the end of a stabilization phase before to start a new phase (28/08/09 at 16:18) the correct conversion parameters (a, b, c parameters) in the initialization of the acquisition SW of the NI have been set. All the data acquired with the NI from this moment on are correct.

The data acquired with the NI software with the wrong parameters set have been scaled during the post-processing of the data.

The recorded temperatures of the Winkratos system, during the post processing of the data, have been scaled by the calibration curves of the sensors.

All the graphs related to the PDS thermal sensors reported in this report have been corrected considering the abovementioned effects. The graphs of the chamber temperature have to be corrected according to the calibration report attached to this report.

REMARK #2

After positioning, all sensors have been tested to verify possible failures after installation and one of them resulted unoperative: external sensor PDS 01. CGS responsible decided to proceed with the test and not to substitute the sensor: it was an auxiliary sensor and its malfunctioning did not affect the test execution.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 10 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

TEST DIARY

DUT incoming: August 24, 2009;
Test Set-Up: August 24 – August 26, 2009;
TVC test: August 26, 2009 – September 2, 2009.
Disassembly: September 2-3, 2009.

TEST SET-UP

During this phase the main activities performed have been:

- unpackage and positioning of the PDS
- thermal sensors positioning in the TVC
- thermal sensors positioning on the PDS
- cabling and MLI positioning

UNPACKAGE AND POSITIONING

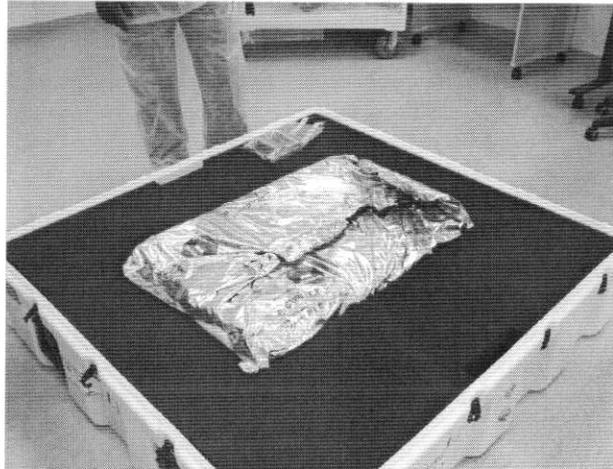


FIGURE 2 – PDS INSIDE THE TRANSPORTATION BOX.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 11 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

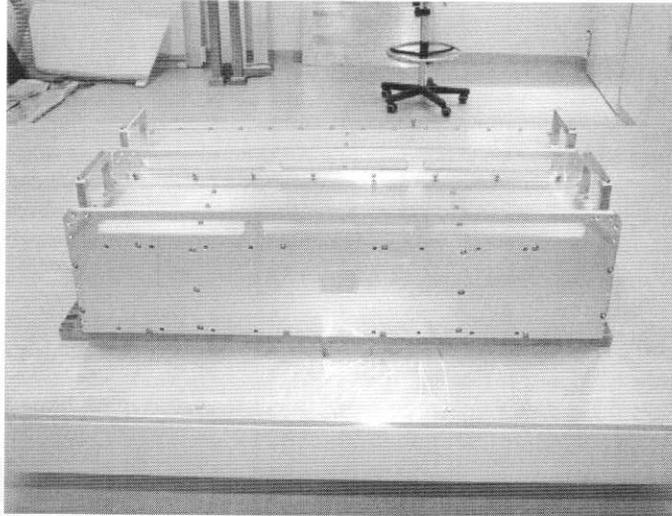


FIGURE 3 – PDS READY FOR THE SENSORS INSTALLATION.

The PDS-PFM has been fixed to the chamber lower cold plate by means of a aluminium fixture (provided by CGS). Cho-term (provided by CGS) has been placed between the PDS and the aluminium fixture.

Cho-term 1674 (provided by SERMS) has been placed between the aluminium fixture and the chamber cold plate (see FIGURE 4).

The aluminium fixture has been fixed to the chamber cold plate using n°29 M4 screws. The torque value used was 2.0 Nm. Two of these screws have not been locked using the nominal torque due to some problems with the metallic insert of the IF plate of the PDS.

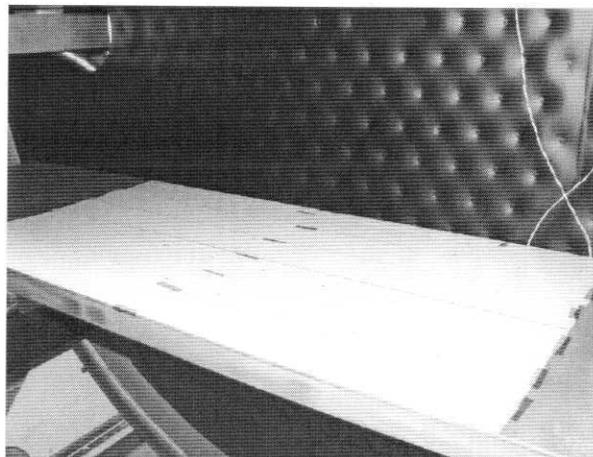


FIGURE 4 - DETAIL OF THE CHO-TERM USED BETWEEN THE PDS ALUMINIUM FIXTURE AND THE CHAMBER COLD PLATE.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 12 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

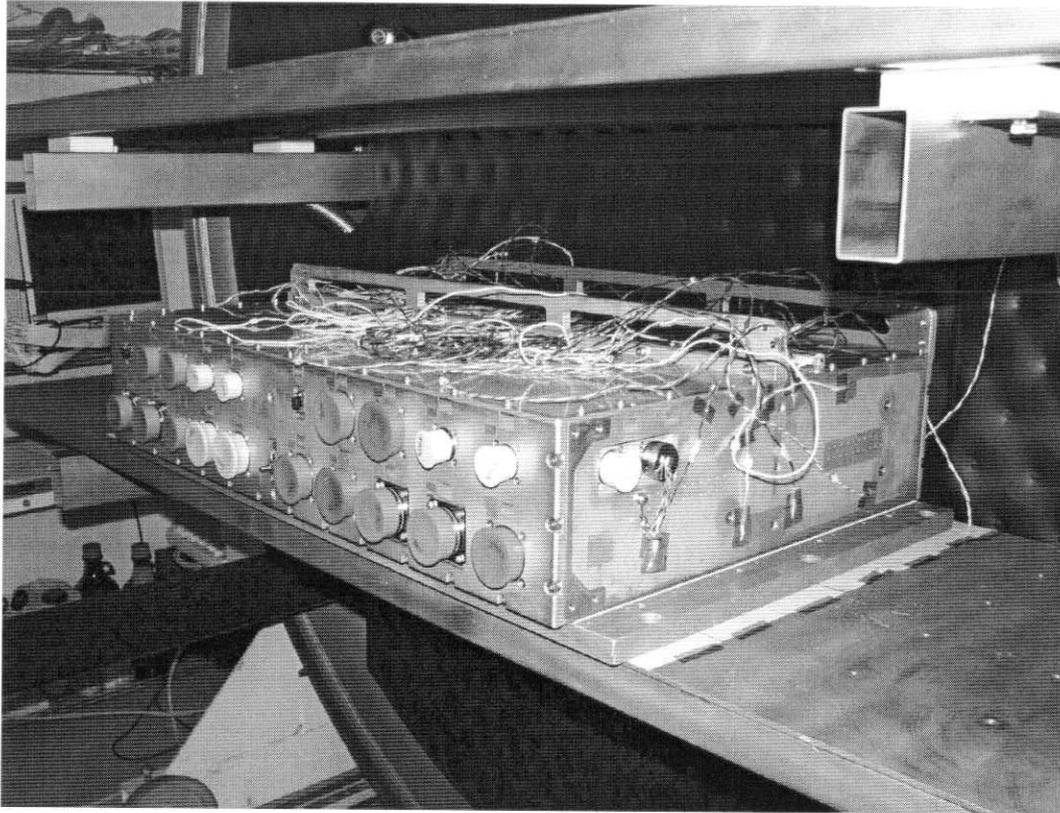


FIGURE 5 – HARDWARE POSITIONING INSIDE THE TVC. THE PDS HAS BEEN FIXED TO THE CHAMBER LOWER COLD PLATE.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 13 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458



FIGURE 6 – DETAIL OF THE PDS FIXTATION ON THE CHAMBER COLD PLATE.

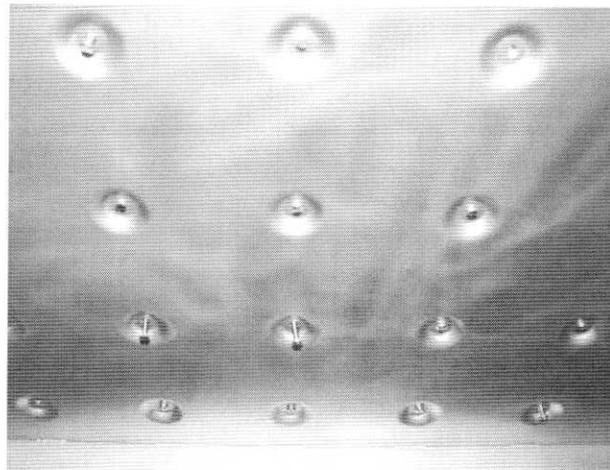


FIGURE 7 – DETAILS OF THE M4 SCREWS USED TO FIX THE PDS ALUMINUM FIXTURE TO THE CHAMBER COLD PLATE.

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

THERMAL SENSORS POSITIONING IN THE TVC

A total of 6 Thermal Sensors (TS) were monitoring the environmental conditions of the test :

- 3 TS were placed on lower cold plate near the PDS fixture: one sensors (ch 5) has been used to control the cold plate temperature while the other two sensors (ch8 and ch9) were used for redundancy reasons.
- 2 TS were placed on the other two cold plate to control their temperature: ch6 on middle cold plate and ch7 on upper cold plate.
- 1 TS was placed on the chamber shroud to control its temperature during the test (ch4).

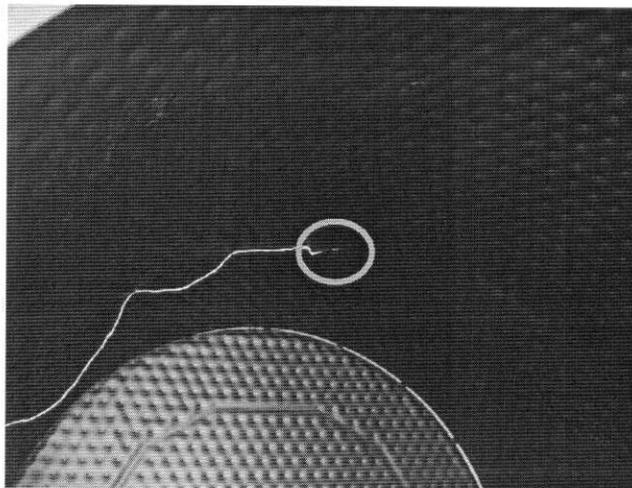


FIGURE 8 – CHAMBER SENSOR 4.

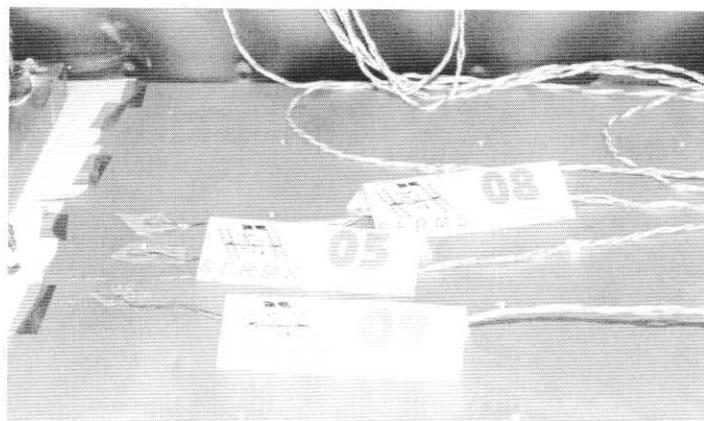


FIGURE 9 – COLD PLATE SENSOR PT n° 05 (to control the cold plate temperature), PT n°08 and PT n°09 (to monitor the cold plate temperature).

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 15 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

THERMAL SENSORS POSITIONING ON THE PDS

A total of 31 Thermal Sensors have been installed on the PDS-PFM by CGS personnel and S.E.R.M.S. personnel under the direction of CGS personnel. All the sensors have been installed on the external walls of the PDS. Four of these sensors (PDS06, PDS07, PDS08, PDS09) have been used as Temperature Reference Points of the test. PDS06 and PDS07 (the main is the PDS06 while the PDS07 is the redundant) are the two TRP for the PDS Bus B; PDS 08 and PDS09 (the main is the PDS08 while the PDS09 is the redundant) are the two TRP for the PDS Bus A.

After positioning, all sensors have been tested to verify possible failures after installation and one of them resulted un-operative: external sensor PDS 01.

After detector disassembly broken connections at soldering points were traced as reason for this problem.

In the following are presented the photographs of all the sensors after positioning.

All the sensors were fixed on the PDS using Kapton tape and covered with Aluminium tape in order to minimize the radiative effect.

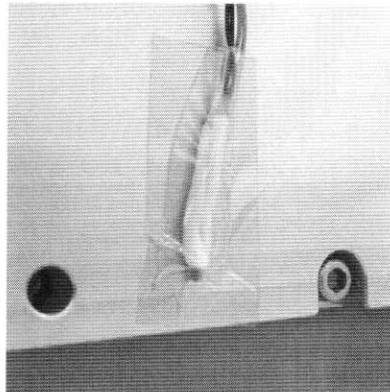


FIGURE 10 – DETAILS OF SENSORS POSITIONING: ALL THE SENSORS HAVE BEEN PLACED USING KAPTON TAPE.

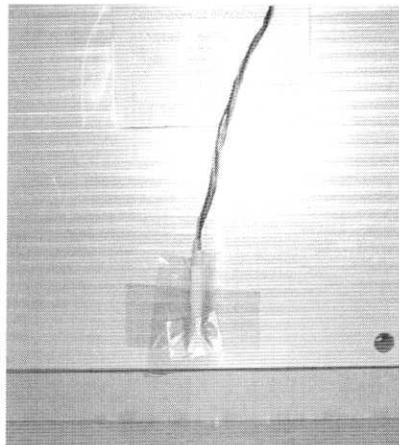


FIGURE 11 – DETAIL OF THE SENSORS POSITIONING: ALL THE SENSORS HAVE BEEN COVERED WITH ALUMINUM TAPE.

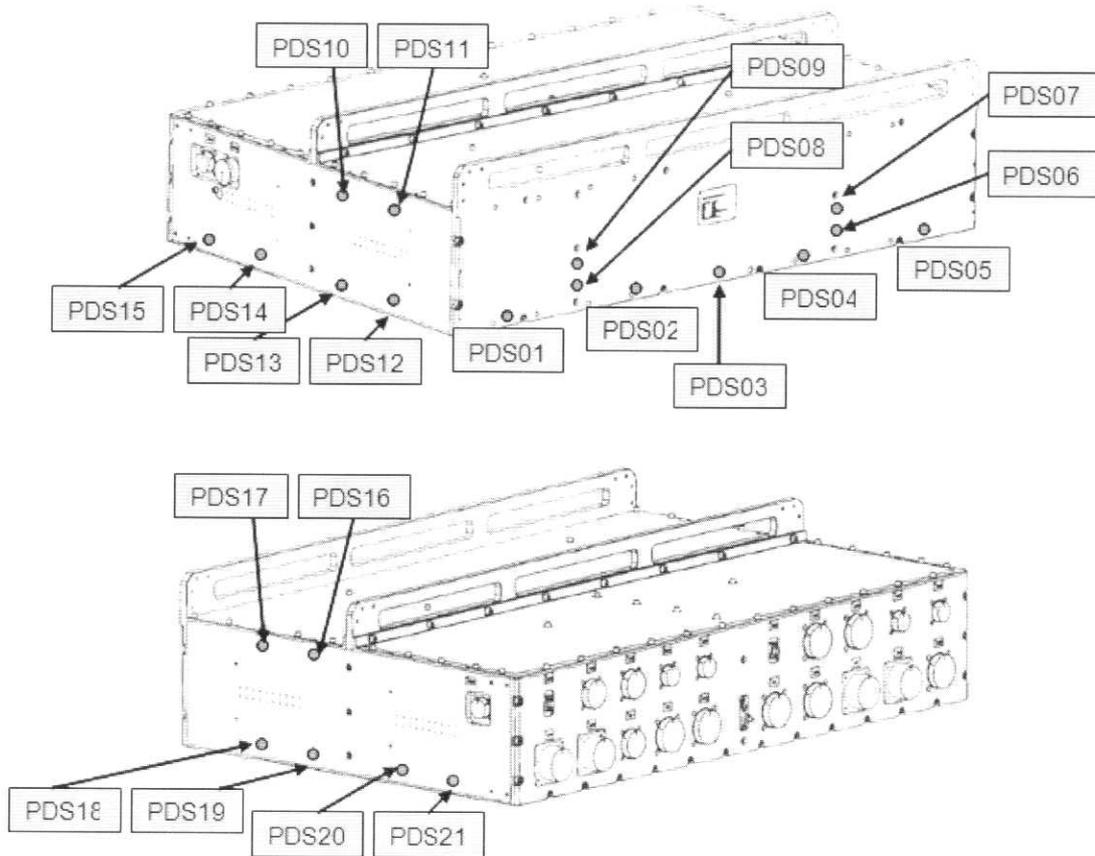


FIGURE 12 – SENSORS POSITION ON FRONT/LATERAL WALLS OF PDS.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 17 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

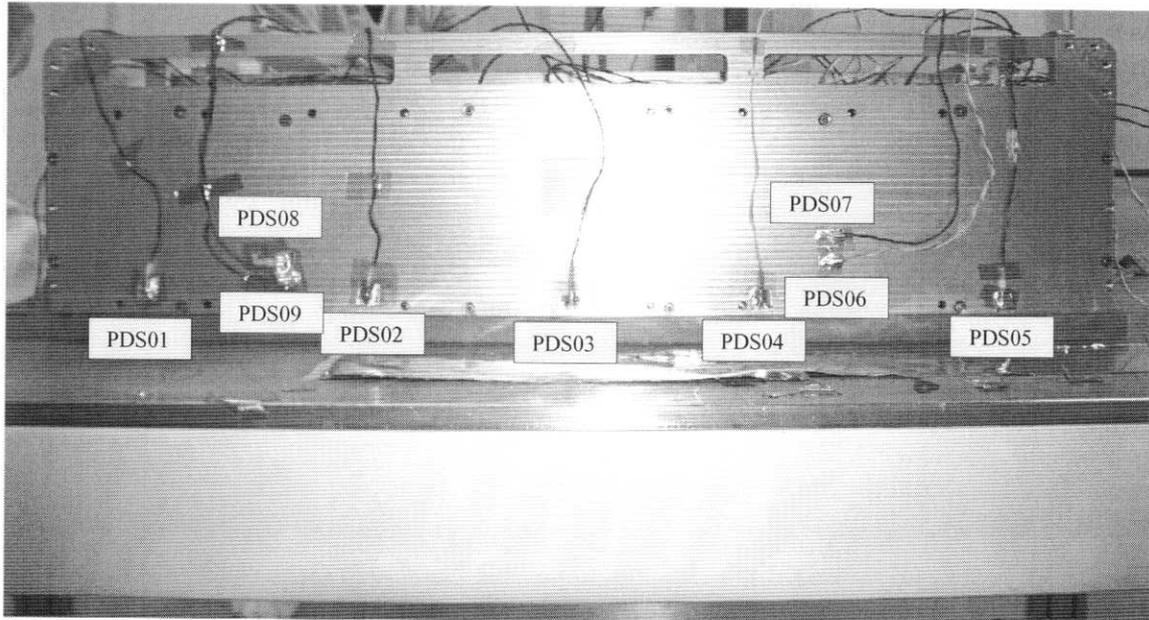


FIGURE 13 – BACK WALLS SENSORS POSITIONING. THE PDS01 SENSOR WAS UN-OPERATIVE. ITS MALFUNCTIONING DID NOT AFFECT THE TEST EXECUTION. ALL THE SENSORS ARE FIXED WITH KAPTON TAPE AND COVERED WITH ALUMINUM TAPE.

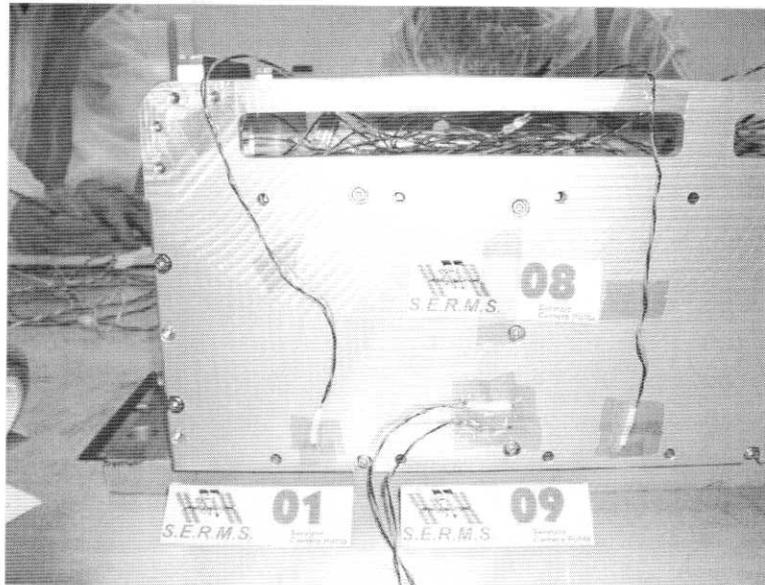


FIGURE 14 – DETAIL OF THE PDS08 AND PDS09 POSITIONING WITH KAPTON TAPE. THESE SENSORS HAVE BEEN USED AS TRP FOR BUS A OF THE PDS.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 18 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

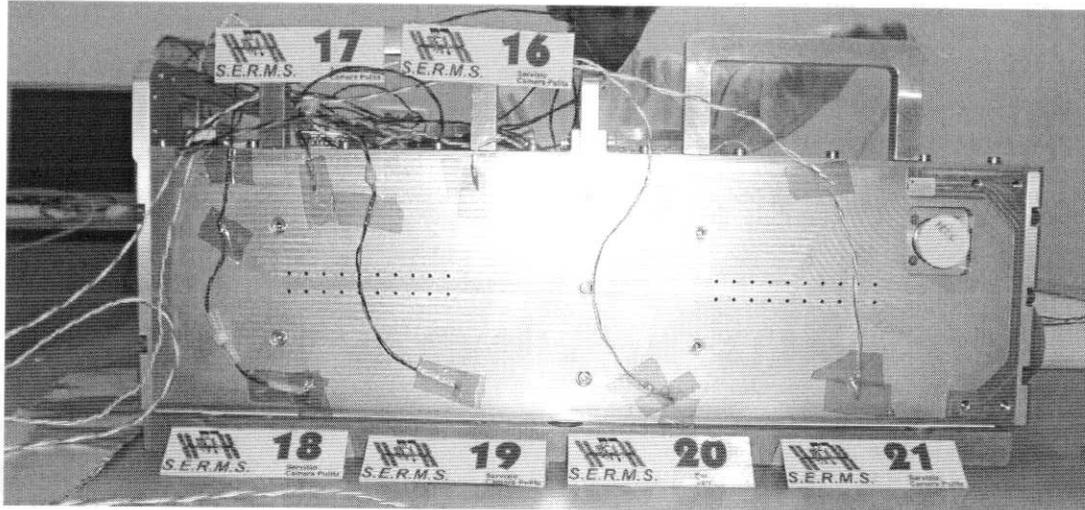


FIGURE 15 – DETAIL OF THE SENSORS POSITIONING ON ONE LATERAL WALL OF THE PDS.

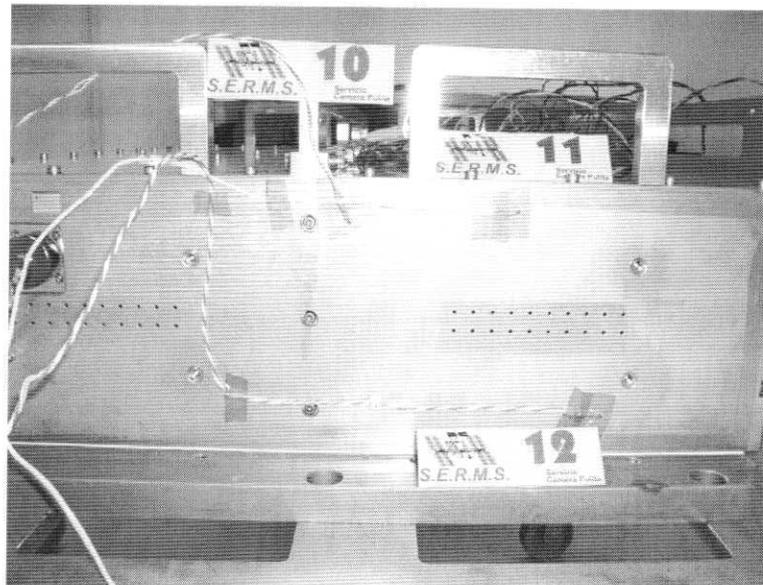


FIGURE 16 – DETAIL OF THE SENSORS POSITIONING PDS 10, PDS11, PDS12 ON ONE LATERAL WALL OF THE PDS.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT

date: 07/09/09

rev: A02

pag: 19 /39

file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

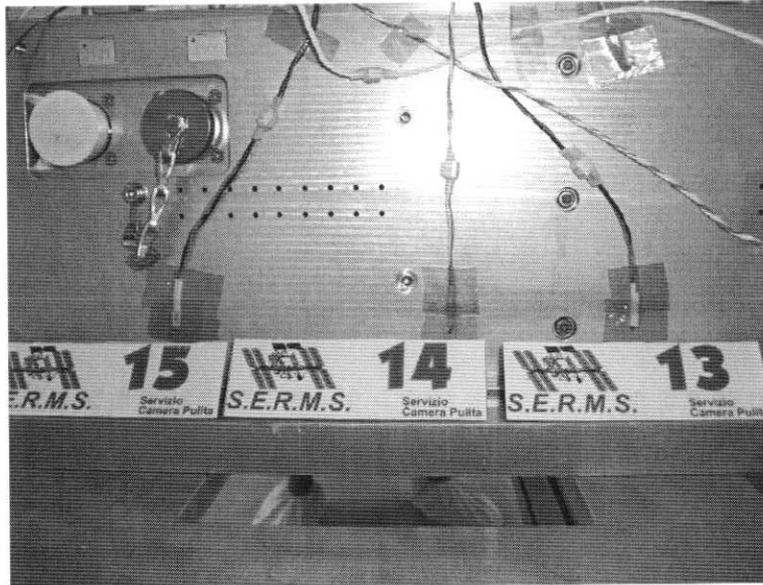


FIGURE 17 – DETAIL OF THE SENSORS POSITIONING PDS 13, PDS14, PDS15 ON ONE LATERAL WALL OF THE PDS.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 20 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

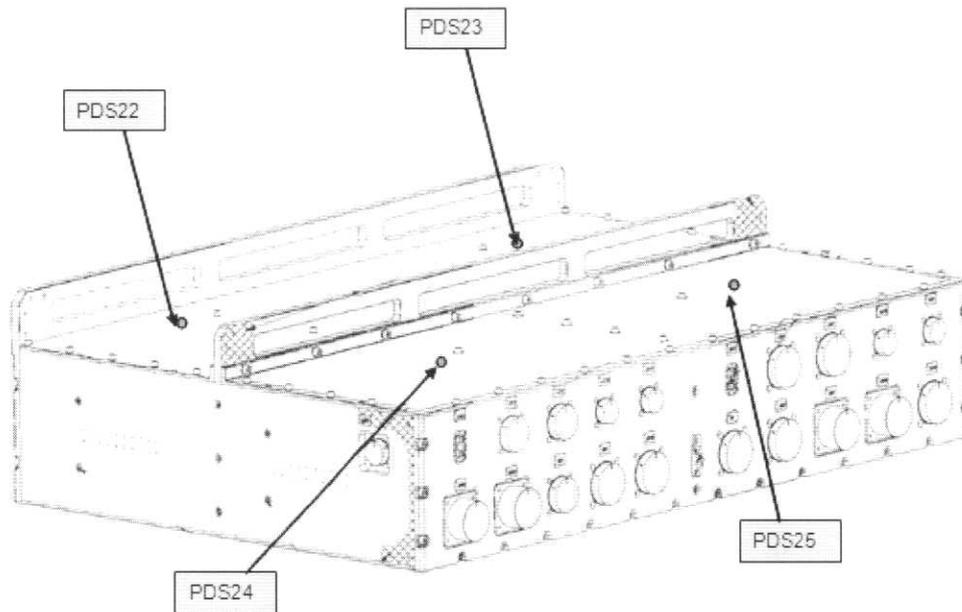


FIGURE 18 – SENSORS POSITION ON TOP COVER.



FIGURE 19 – PDS 23 SENSOR POSITION.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 21 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458



FIGURE 20 – PDS 24 SENSOR POSITION.



FIGURE 21 – PDS 25 SENSOR POSITION.

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

Other sensors shall be positioned on the interface plate in order to measure the temperature impedance given by the contact connection between PDS baseplate, and IF plate.

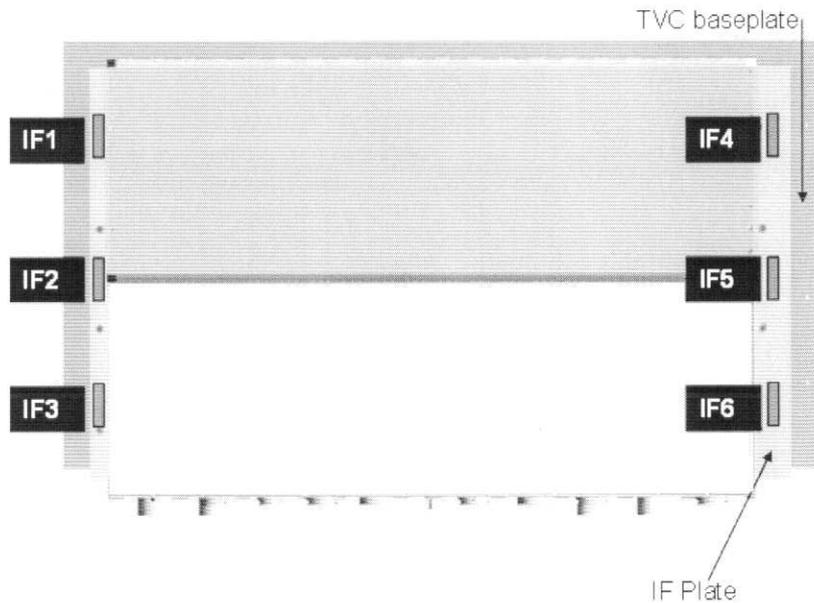


FIGURE 22 – EXTERNAL IF PLATE SENSORS POSITION.



FIGURE 23 – EXTERNAL SENSORS POSITION: IF1 IS THE CH26, IF2 IS THE CH27, IF3 IS THE CH28.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 23 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

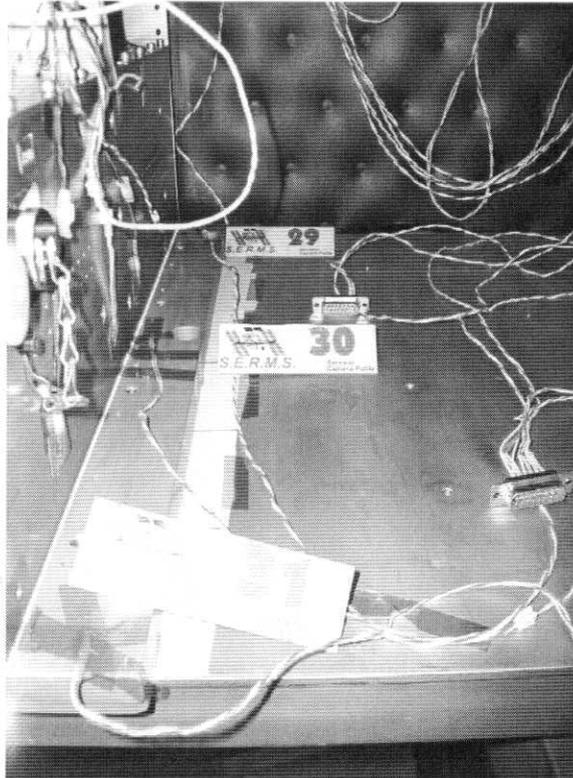


FIGURE 24 – EXTERNAL SENSORS POSITION: IF4 IS THE CH29, IF5 IS THE CH30, IF6 IS THE CH31.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 24 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

CABLING AND MLI POSITIONING

Before to start the tests the PDS has been cabled and completely covered with MLI (Multi Layer Insulation).

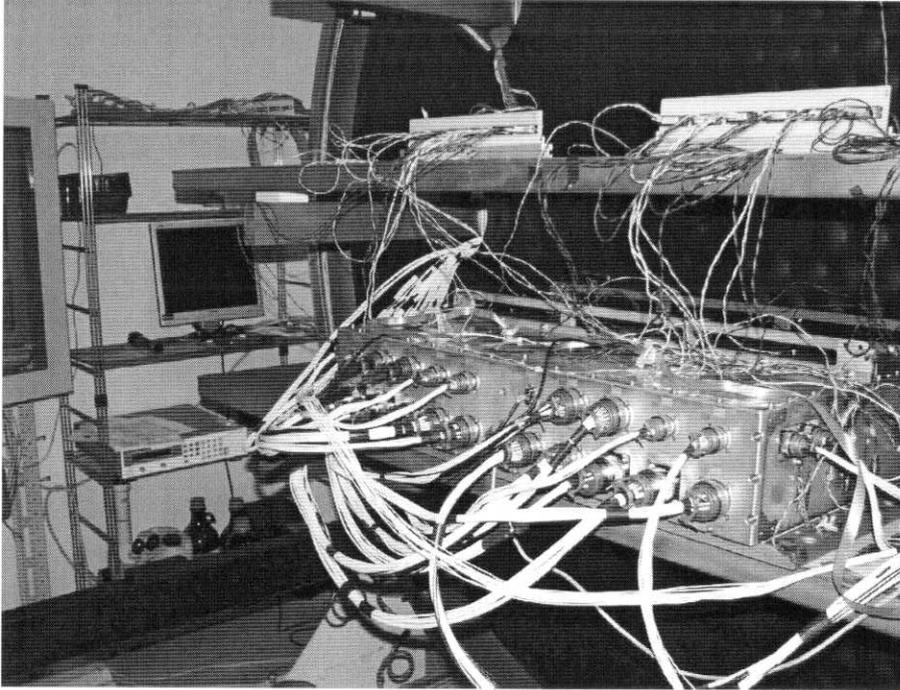


FIGURE 25 – CABLING OF THE PDS.

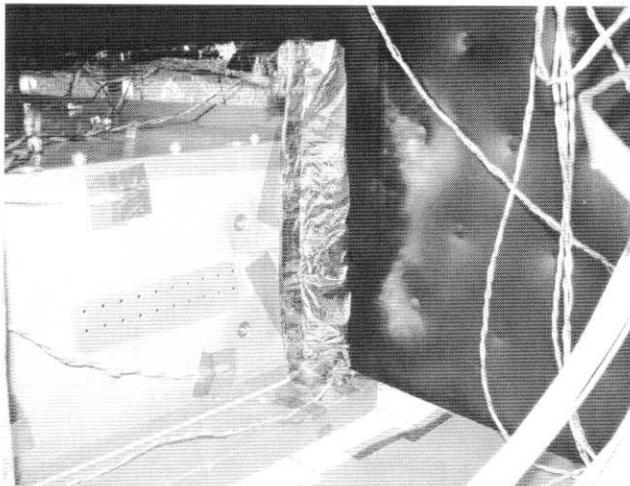


FIGURE 26 – DETAIL OF THE MLI POSITIONING.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 25 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

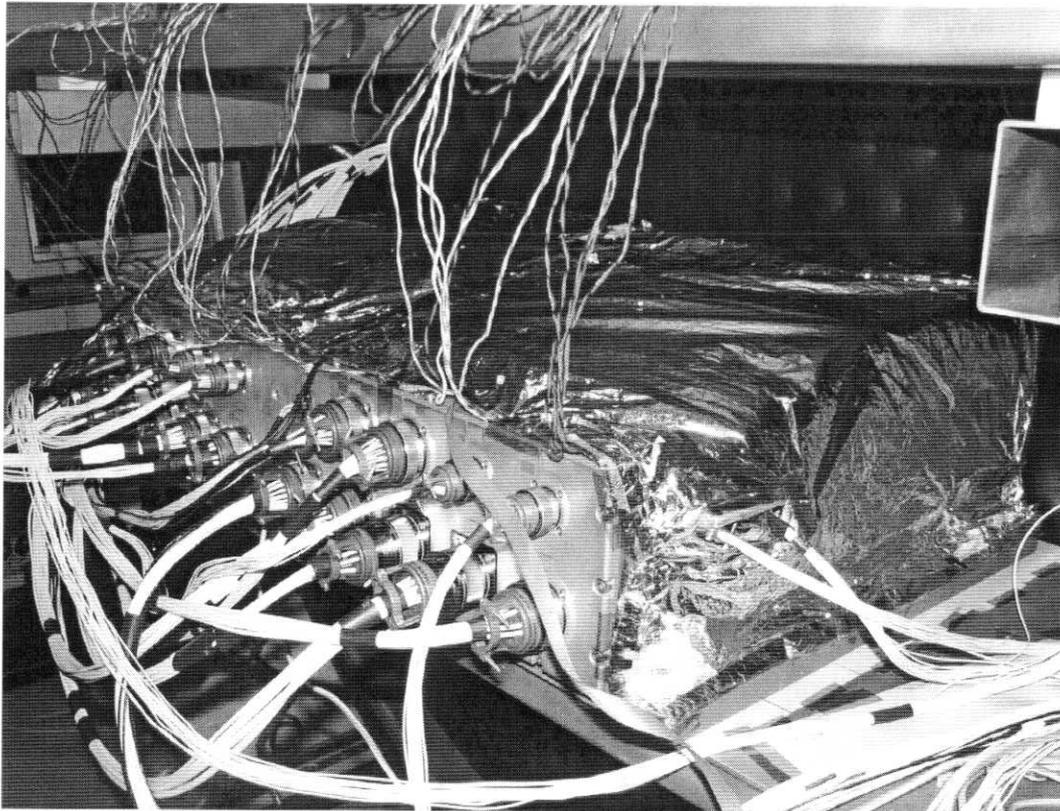


FIGURE 27 – PDS COVERED WITH MLI AND READY TO BE TESTED.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui Materiali
per lo Spazio

Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
pag: 26 /39
file: ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

TEST GRAPHS

All the control and environmental parameters in the TVC have been continuously monitored and recorded during the test. The PDS temperatures have been continuously monitored in 30 locations (the PDS01 sensors was un-operative) and their values recorded during the whole test period.

In this section, the graphs summarizing the temporal evolution of all measured quantities during the whole test period are reported.

Hereby the S.E.R.M.S. guarantees that:

- the handling of the test data has been done only by qualified members of the S.E.R.M.S staff.
- all graphs presented in this report and its annex are a truthful representation of the recorded data including the correction of the resistance/temperature curve mentioned in the previous sections and have been solely produced by the S.E.R.M.S. engineer in charge of the test.

The complete set of recorded data can be provided on customer request.

More detailed graphs relative to specific measurements can be produced on customer request.

NOTE: The temperature values of the chamber cold plate (ch5, ch8, ch9) where the PDS has been fixed, must be scaled using the calibration results of each sensor (see the calibration report attached to this report).

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 27 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

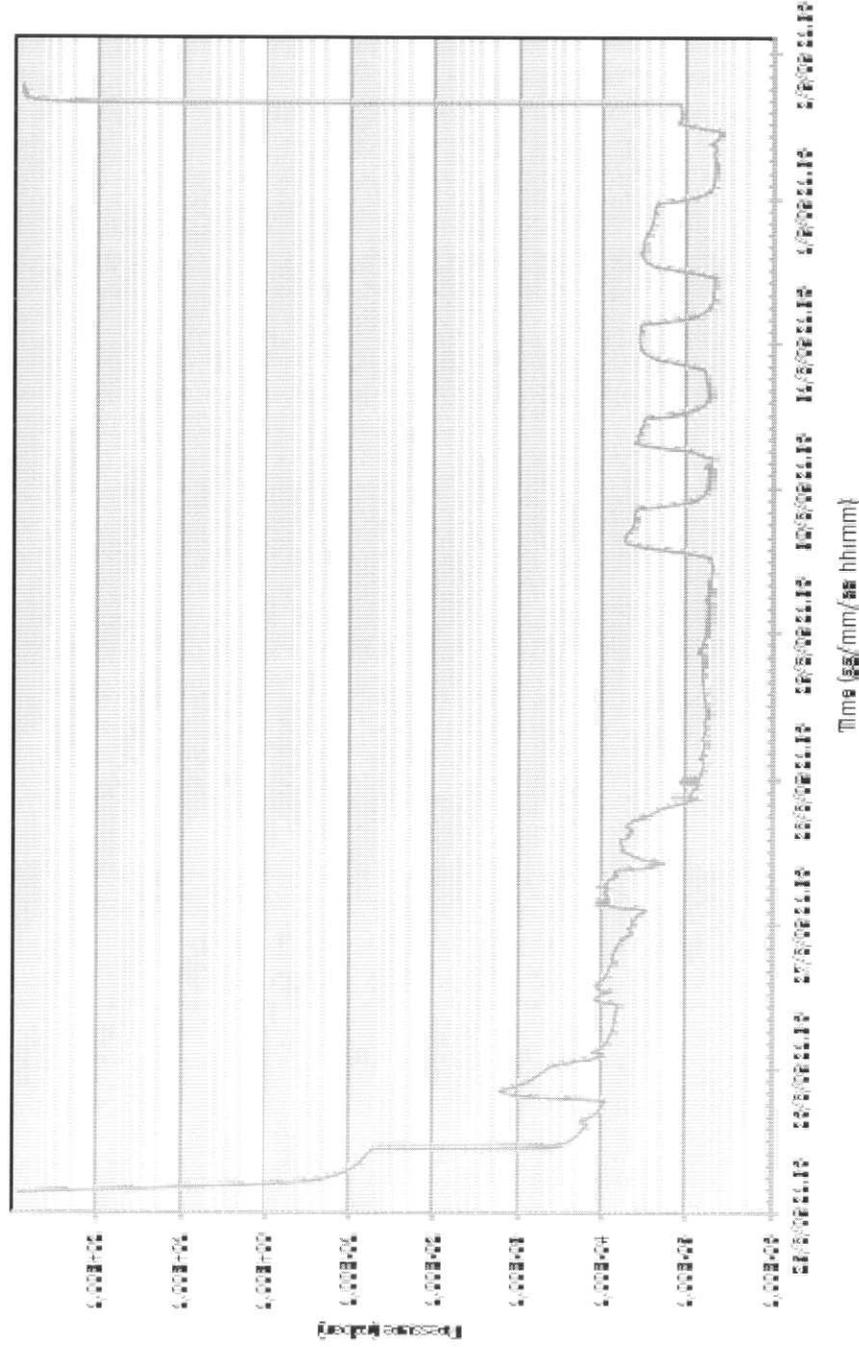


FIGURE 28 – PRESSURE PROFILE OF THE TEST.

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 28 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

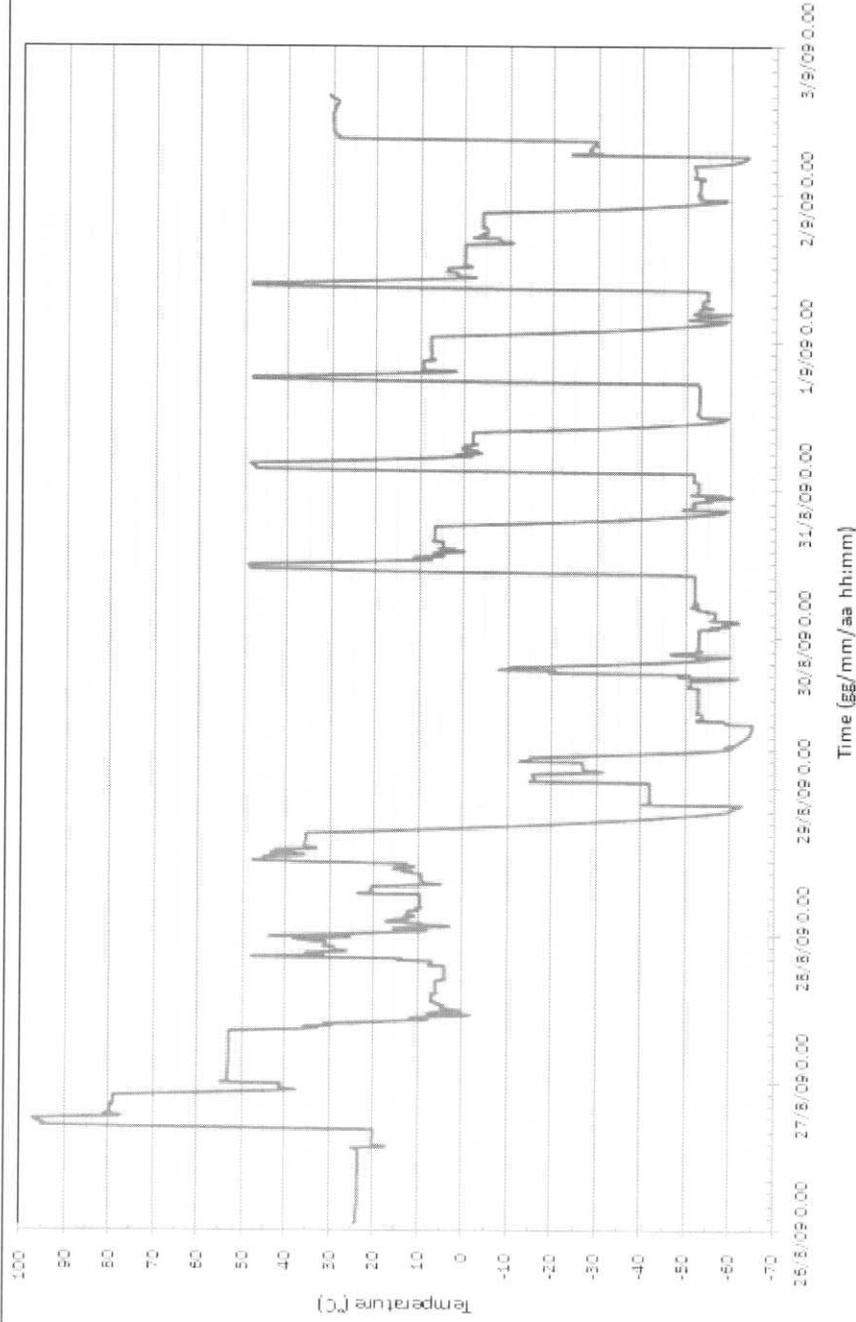


FIGURE 29 – LOWER COLD PLATE TEMPERATURE PROFILE: CH5 SENSOR.

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 29 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

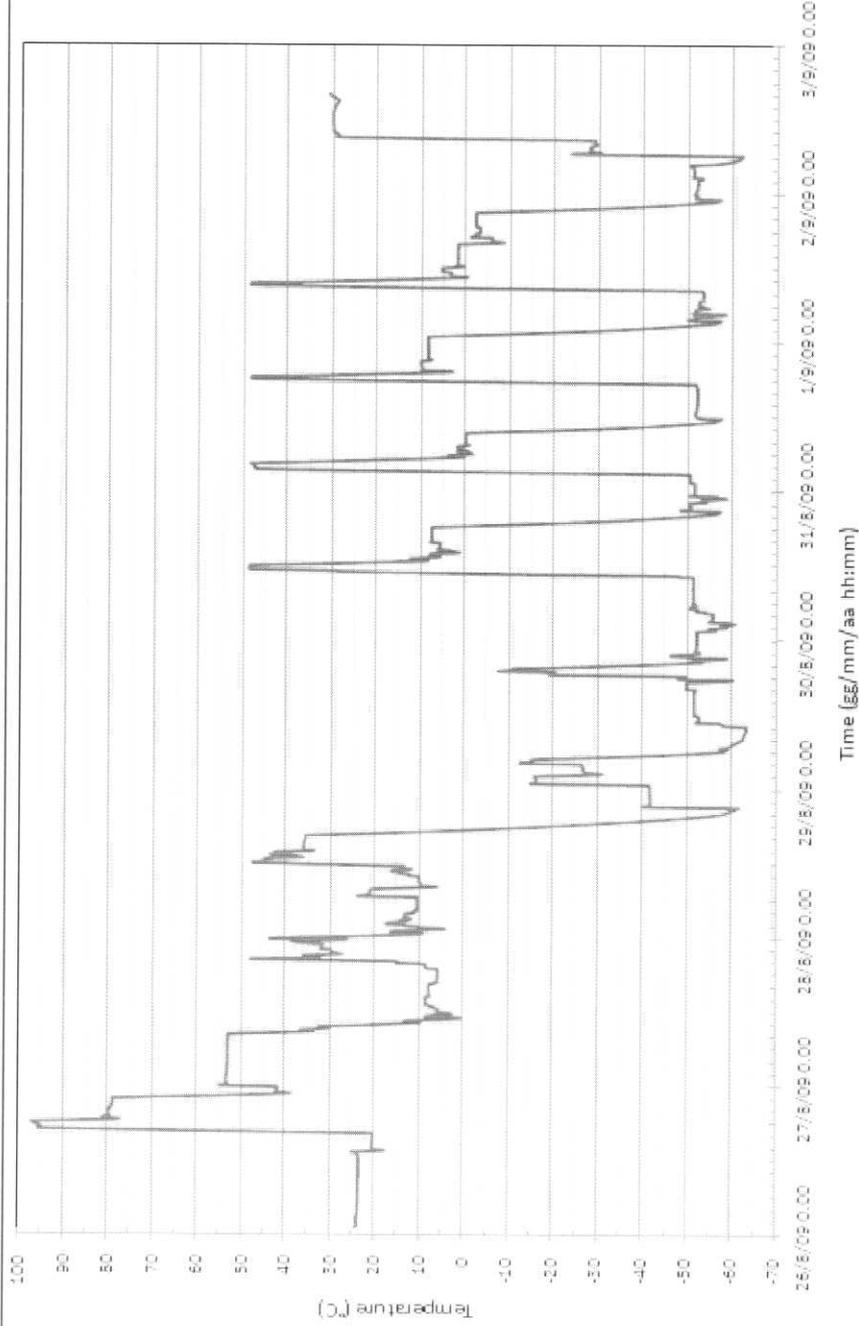


FIGURE 30 – LOWER COLD PLATE TEMPERATURE PROFILE: CH8 SENSOR.

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 30 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

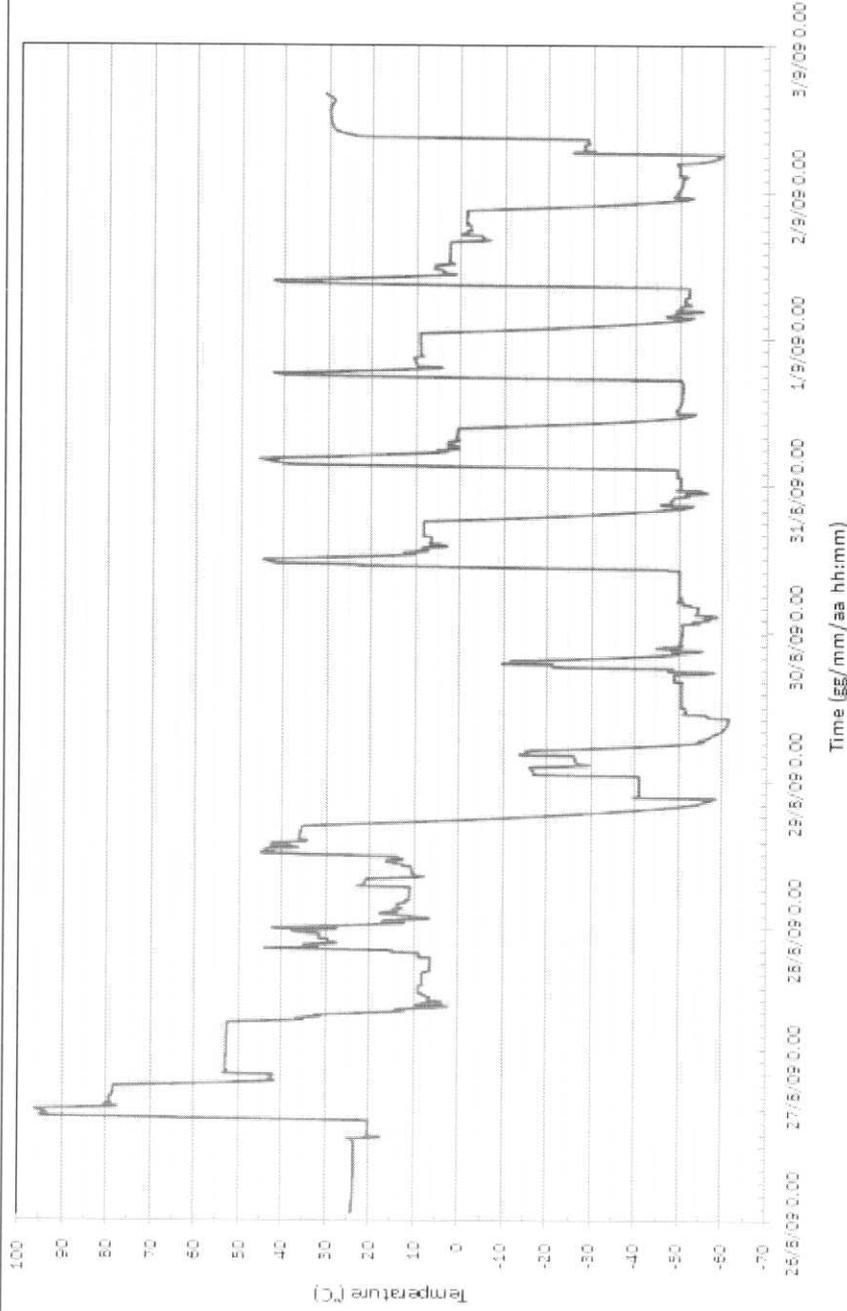


FIGURE 31 – LOWER COLD PLATE TEMPERATURE PROFILE: CH9 SENSOR.

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Penitima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 31 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

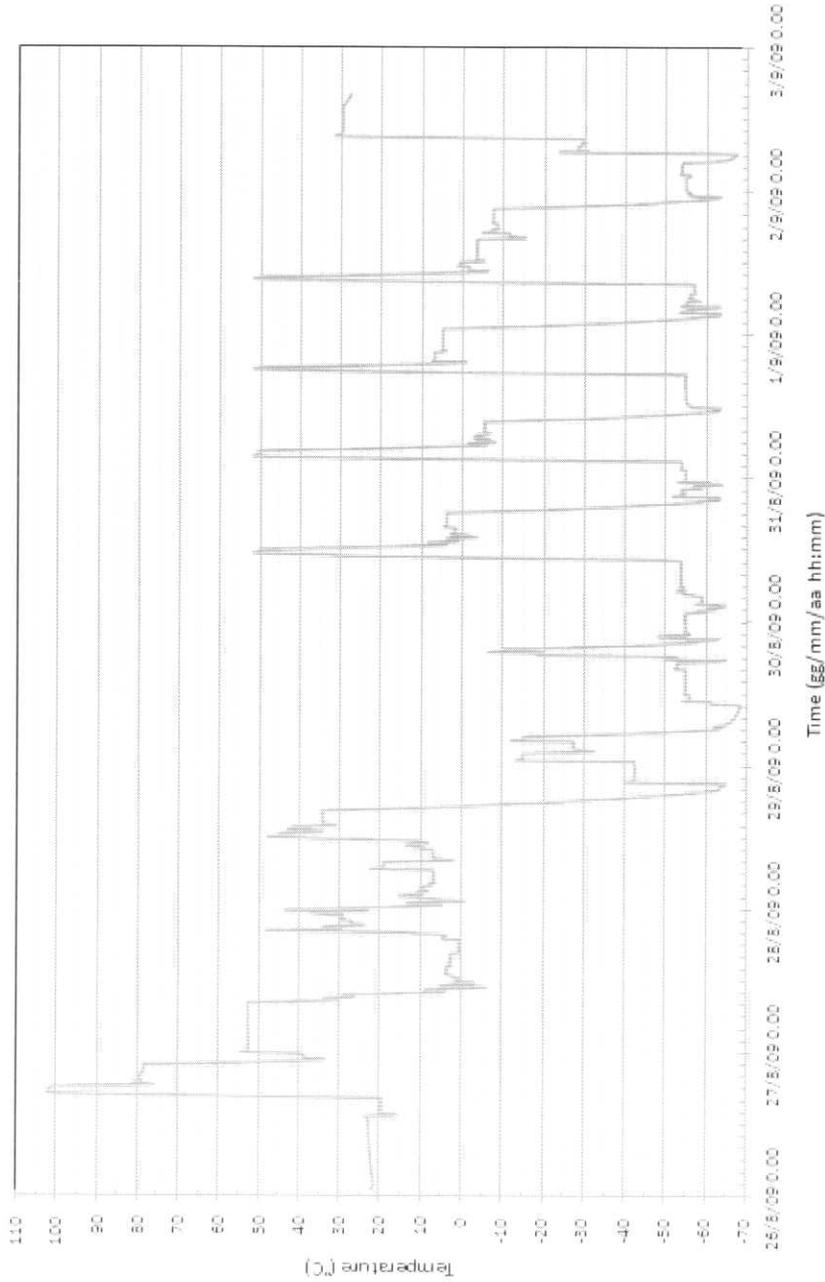


FIGURE 32 – MIDDLE COLD PLATE TEMPERATURE PROFILE: CH6 SENSOR.

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 32 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

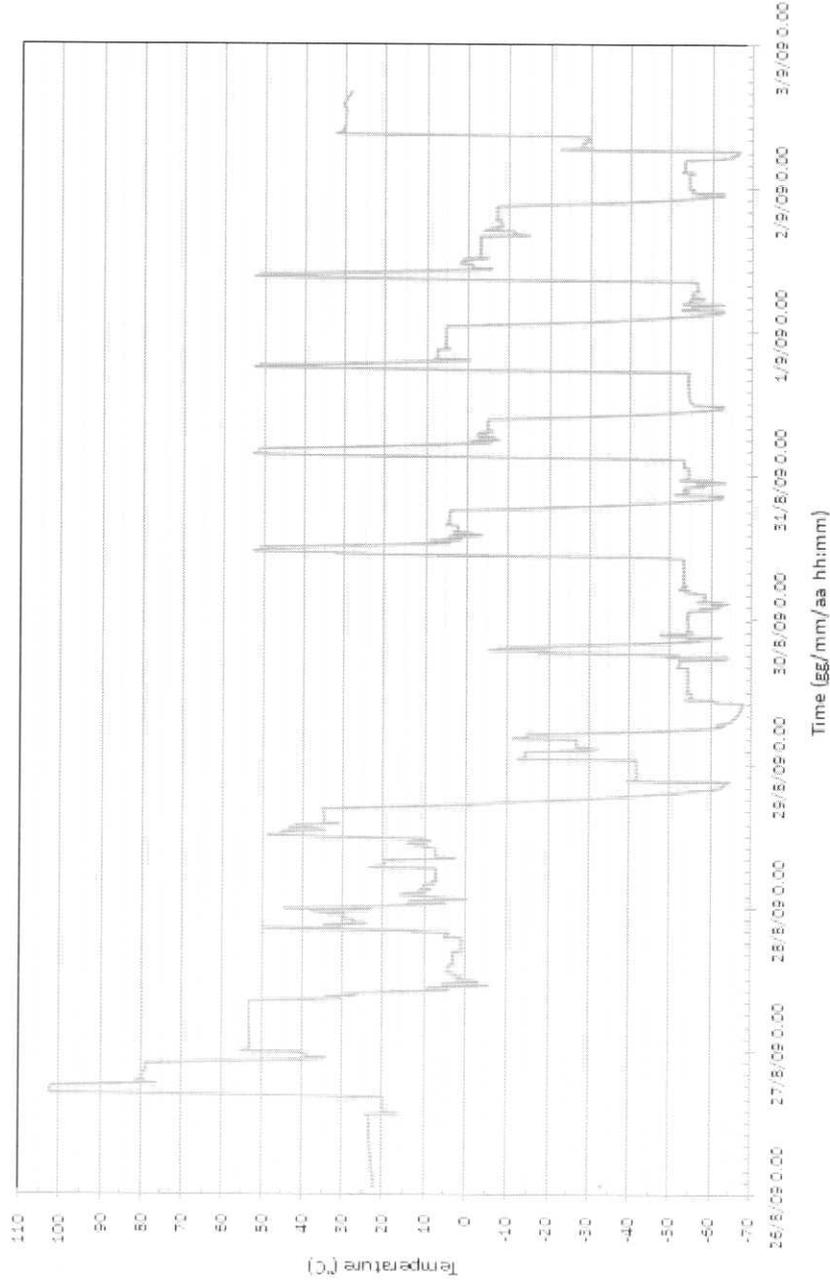


FIGURE 33 – UPPER COLD PLATE TEMPERATURE PROFILE: CH7 SENSOR.

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 33 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

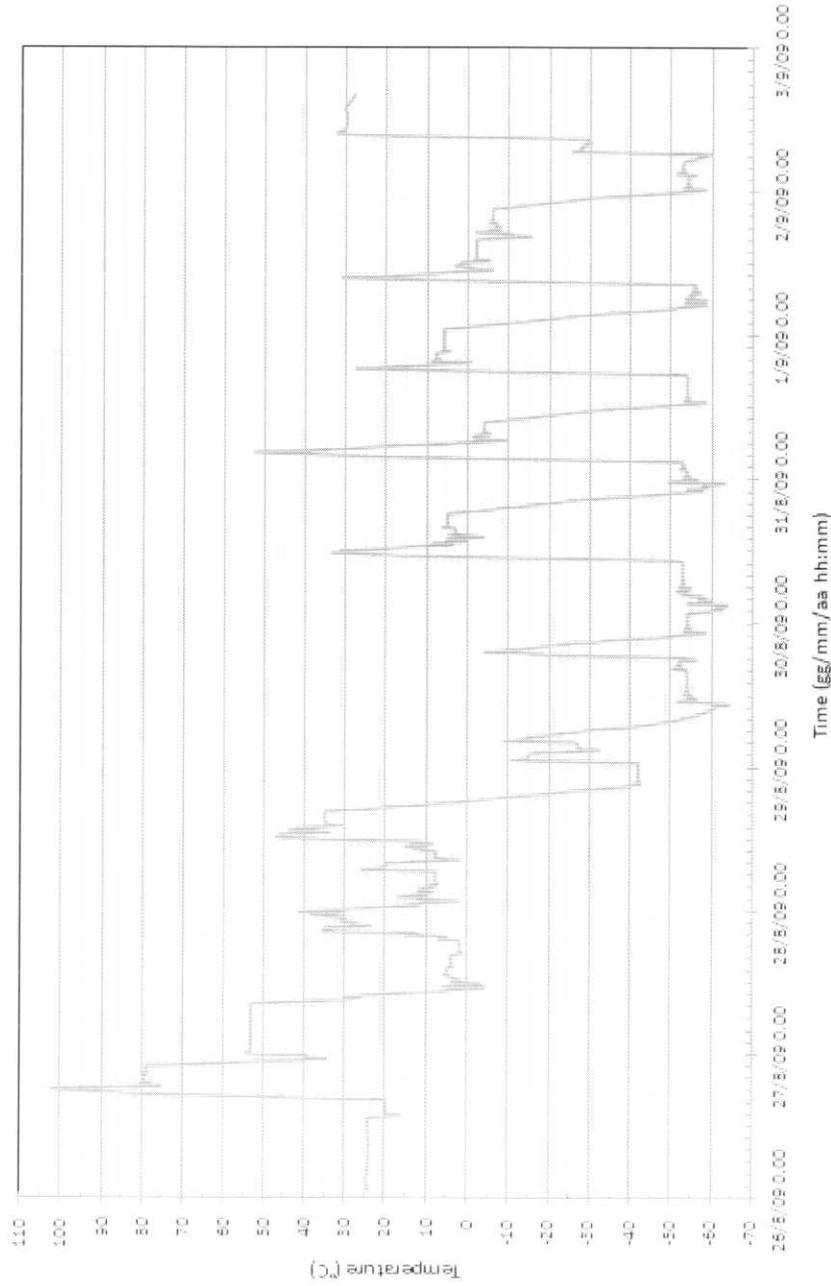


FIGURE 34 – SHROUD TEMPERATURE PROFILE: CH4 SENSOR.

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Penitima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 34 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

PDS TRP

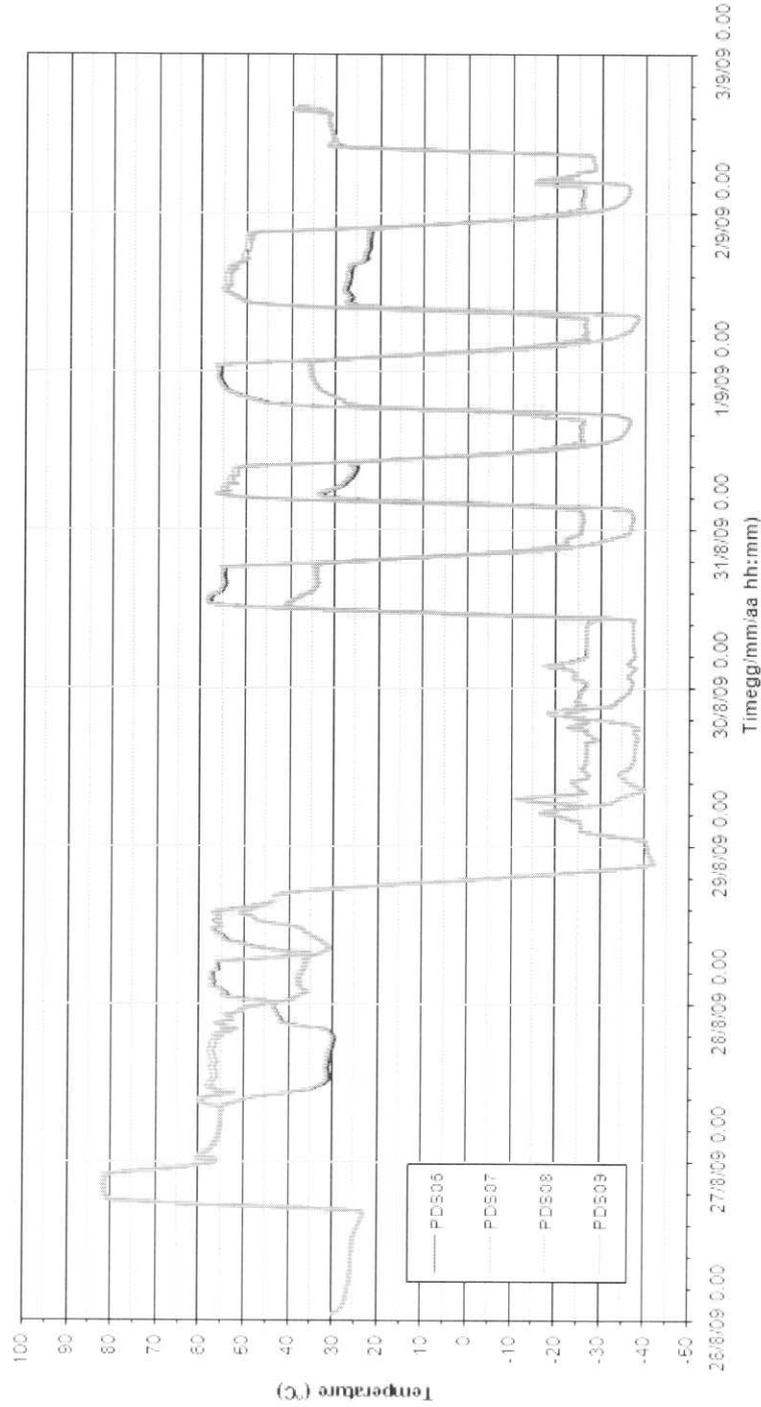


FIGURE 35 – PDS TRP TEMPERATURE PROFILE.

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 35 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

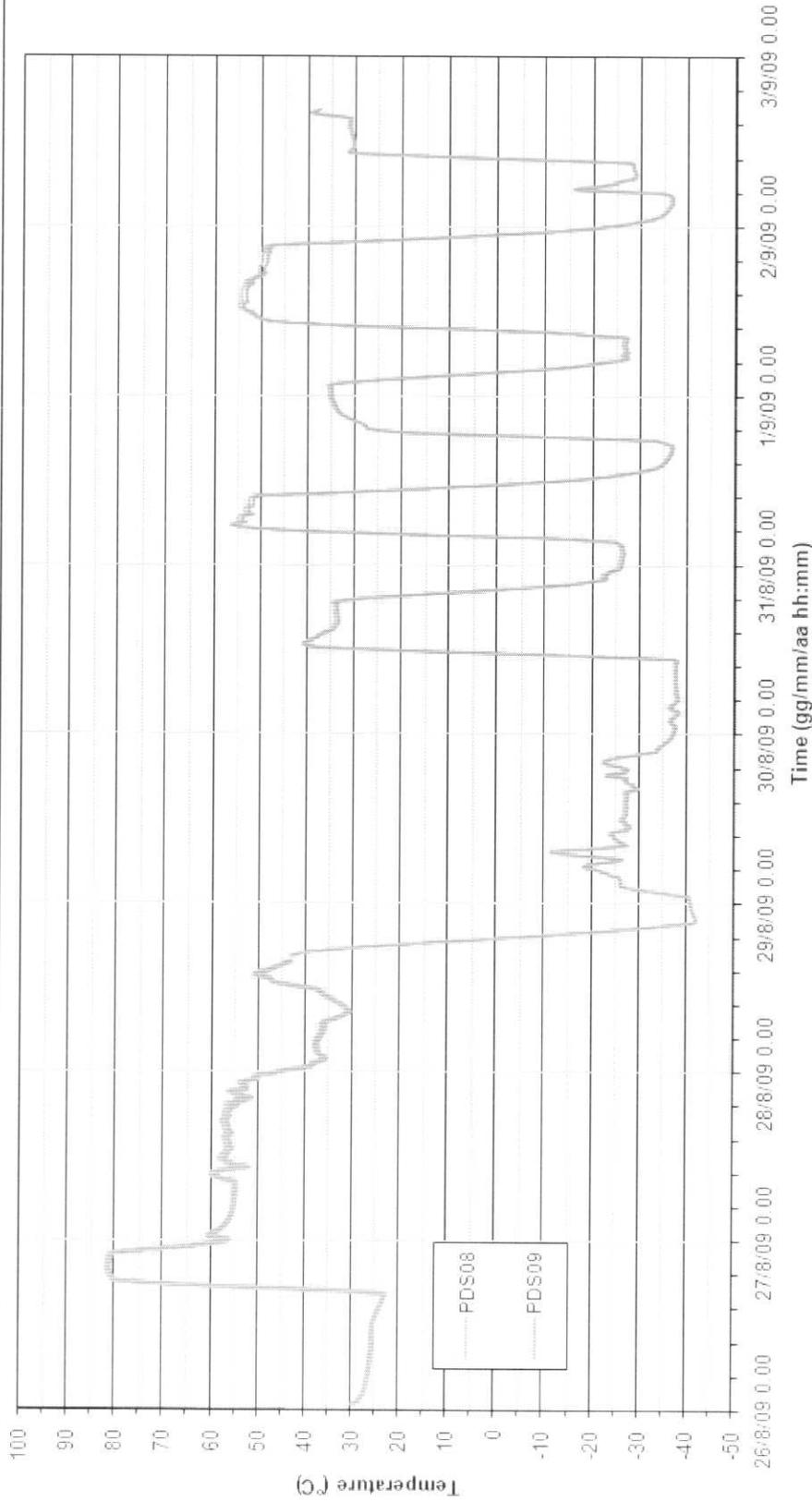


FIGURE 36 – PDS-BUS A TRP TEMPERATURE PROFILE.

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Penitima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 36 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

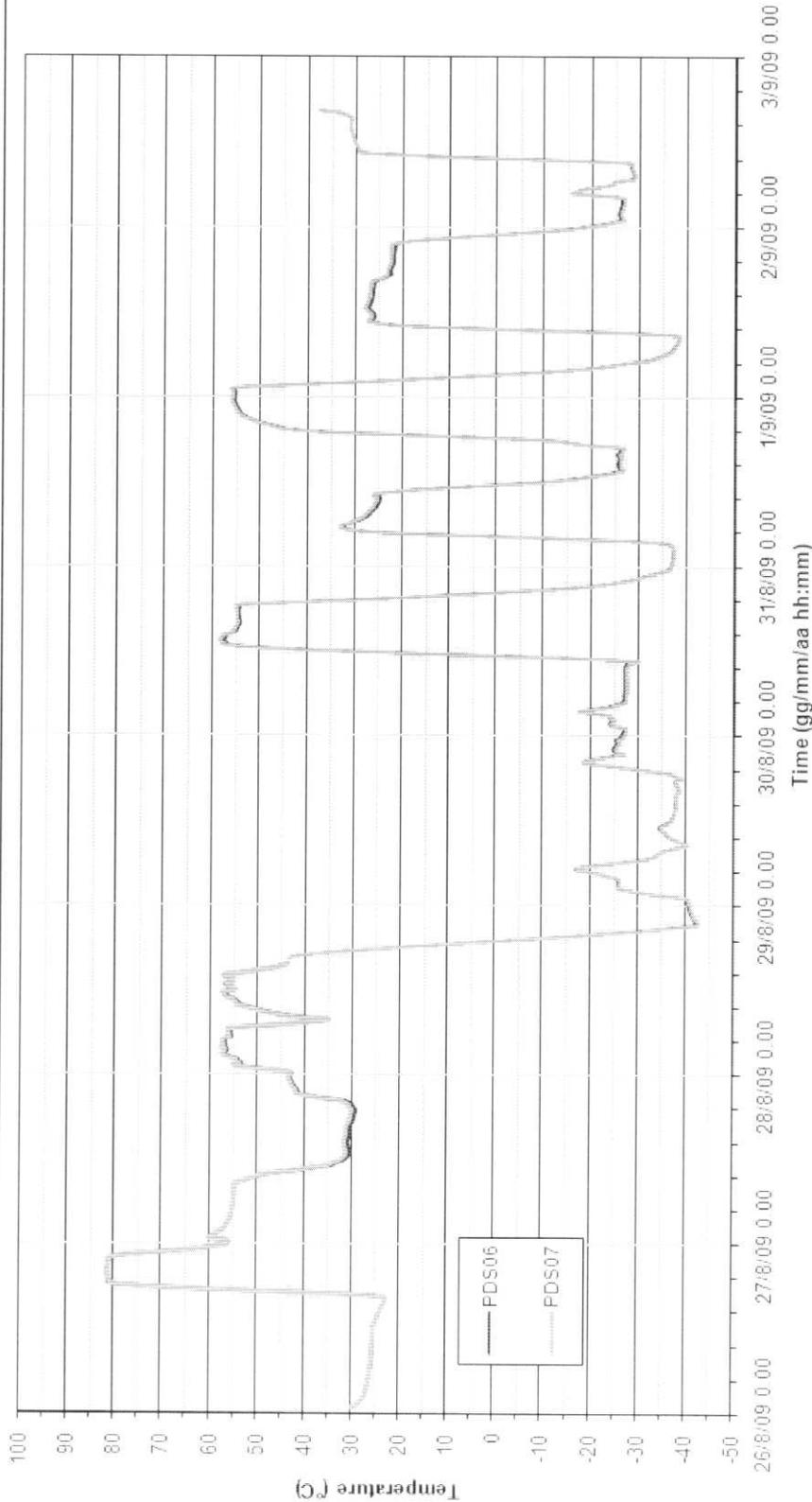


FIGURE 37 – PDS-BUS B TRP TEMPERATURE PROFILE.

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 37 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

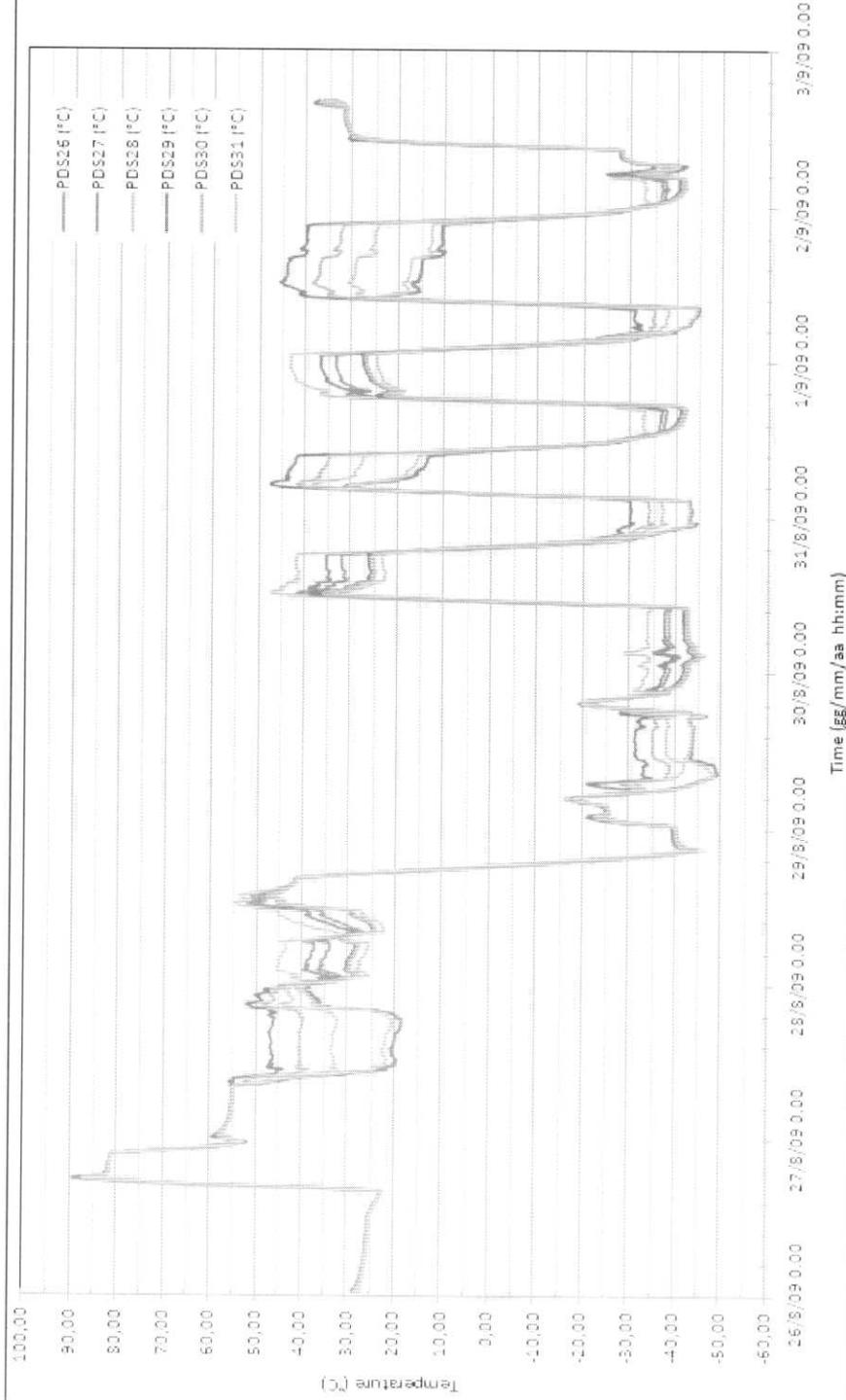


FIGURE 38 – PDS IF PLATE TEMPERATURE PROFILE.

SERMS

Laboratorio per lo Studio
degli Effetti delle Radiazioni sui Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
date: 07/09/09
rev: A02
page: 38 / 39
file: ENVRPT149_S2413R-A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

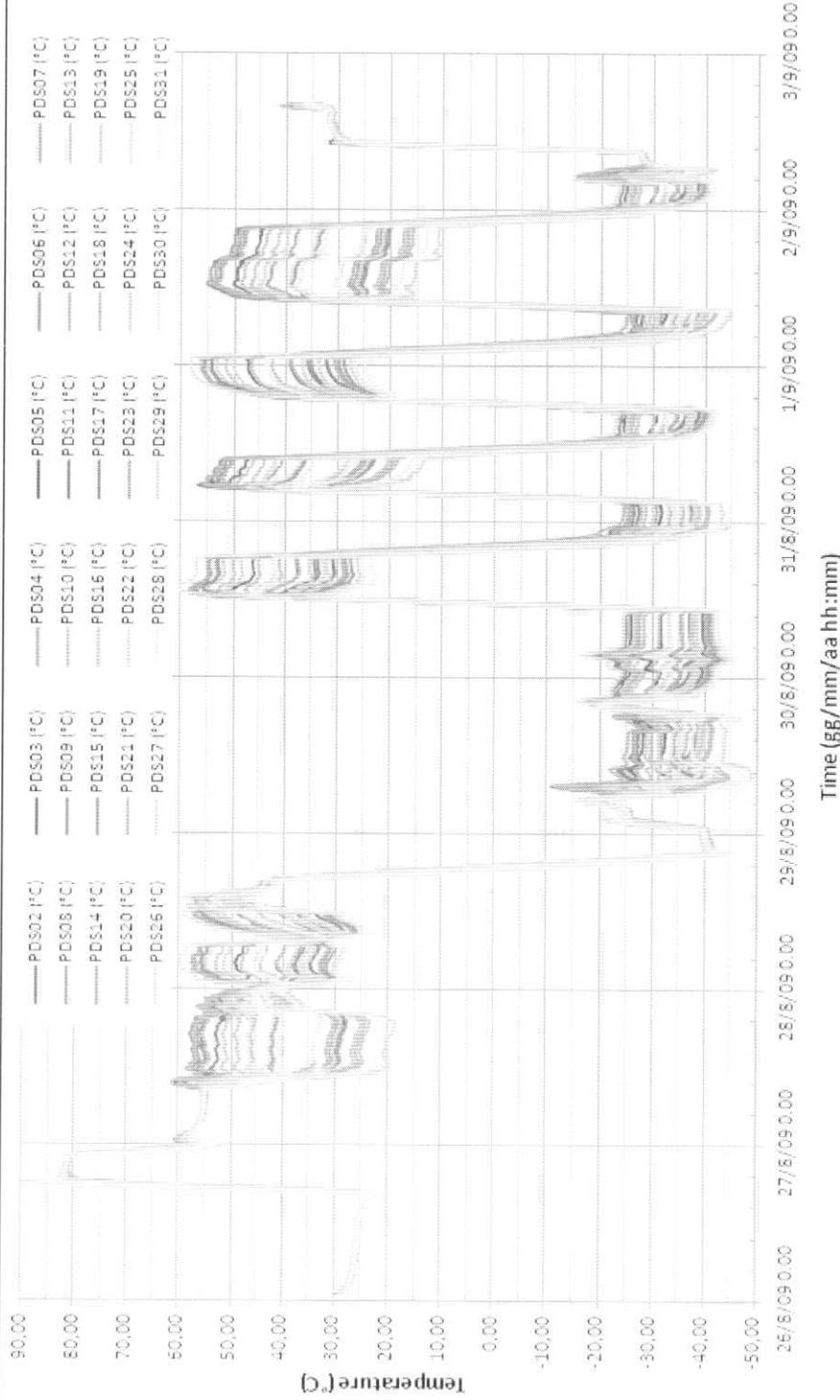


FIGURE 39 – ALL PDS SENSORS (N°31 PT100) TEMPERATURE PROFILE.

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui
Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

ENVIRONMENTAL TEST REPORT

doc: PDS TVT
data: 07/09/09
rev: A02
pag: 39 di 39
file:
ENVRPT149_S2413R-
A02-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

END OF DOCUMENT

SERMS

Laboratorio per lo Studio degli
Effetti delle Radiazioni sui
Materiali per lo Spazio
Via Pentima Bassa, 21 Terni
05100 TR
phone/fax: +39.0744.49.29.13

**ENVIRONMENTAL
TEST REPORT –
ANNEX 01**

doc: PDS TVT –
ANNEX01
data: 07/09/09
rev: A01
pag: 1 di 1
file:
ENVRPT149_S2413R-
ANNEX01-07SEP2K9

Carlo Gavazzi Space - Via Gallarate 150 - 20151 Milano Italy - Tel. +39.02.380481 - Fax. +39.02.3086458

**ANNEX 01
SENSOR CALIBRATION
REPORT**



RAPPORTO DI TARATURA N° 290052

E' costituito da n° 4 fogli

- in data 23/01/09

- destinatario S.E.R.M.S. SRL

- richiesta n° 99/OR

- in data 22/05/09

Si riferisce a:

- oggetto TERMORESISTENZA PT100 4 FILI CLASSEB

- costruttore MINCO

- modello e s/n NON NOTO s/n NON NOTO

- matricola VARIE

- reparto / impianto LABORATORIO SIMULATORE SPAZIALE

- data ricevimento strumento verifica c/o S.E.R.M.S. - Terni

- data delle misure 20-21-22/01/09

- registro di laboratorio 290052

RESPONSABILE DEL LABORATORIO

Dott. Grezzi Decio

I risultati di misura riportati nel presente rapporto sono stati ottenuti applicando la procedura operativa di taratura n°T001 la cui catena di riferibilità ha inizio dai ns. campioni 02T -34T, muniti di certificato valido di taratura n° C10703137 rev.0 (scad. 07/2009), emesso dal centro SIT 51.

La riproduzione del presente documento è ammessa in copia conforme integrale. La riproduzione parziale è ammessa solo a seguito di autorizzazione scritta da parte del Responsabile di Laboratorio.

Modulo 08-rev.0

RISULTATI DELLE MISURAZIONI

N°	VALORE DI RIFERIMENTO °C	Pt 100 n° 4		Pt 100 n° 5		Pt 100 n° 6	
		VALORE MISURATO	ERRORE ASSOLUTO	VALORE MISURATO	ERRORE ASSOLUTO	VALORE MISURATO	ERRORE ASSOLUTO
		°C	°C	°C	°C	°C	°C
1	-69,9	-67,7	2,2	-70,2	-0,3	-70,9	-1,0
2	-44,1	-44,4	-0,3	-44,7	-0,6	-45,3	-1,2
3	-29,1	-30,0	-0,9	-29,7	-0,6	-30,3	-1,2
4	-9,1	-9,9	-0,8	-9,7	-0,6	-10,3	-1,2
5	21,2	20,0	-1,2	20,3	-0,9	19,7	-1,5
6	31,2	30,1	-1,1	30,3	-0,9	29,6	-1,6
7	51,2	50,1	-1,1	50,3	-0,9	49,7	-1,5
8	81,3	79,9	-1,4	80,3	-1,0	79,6	-1,7
9	101,5	100,0	-1,5	100,4	-1,1	99,7	-1,8
10	121,4	120,3	-1,1	120,3	-1,1	119,7	-1,7

N°	VALORE DI RIFERIMENTO °C	Pt 100 n° 7		Pt 100 n° 8		Pt 100 n° 9	
		VALORE MISURATO	ERRORE ASSOLUTO	VALORE MISURATO	ERRORE ASSOLUTO	VALORE MISURATO	ERRORE ASSOLUTO
		°C	°C	°C	°C	°C	°C
1	-69,9	-70,6	-0,7	-70,3	-0,4	-70,4	-0,5
2	-44,1	-45,0	-0,9	-44,9	-0,8	-44,8	-0,7
3	-29,1	-30,0	-0,9	-29,9	-0,8	-29,8	-0,7
4	-9,1	-9,9	-0,8	-9,9	-0,8	-9,8	-0,7
5	21,2	20,0	-1,2	20,1	-1,1	20,1	-1,1
6	31,2	30,0	-1,2	30,0	-1,2	30,1	-1,1
7	51,2	50,0	-1,2	50,0	-1,2	50,1	-1,1
8	81,3	80,0	-1,3	79,9	-1,4	80,0	-1,3
9	101,5	100,1	-1,4	99,9	-1,6	100,1	-1,4
10	121,4	120,0	-1,4	119,9	-1,5	120,0	-1,4

Errore assoluto = valore misurato - valore di riferimento

OPERATORE



RISULTATI DELLE MISURAZIONI

N°	VALORE DI RIFERIMENTO °C	Pt 100 n° 10		Pt 100 n° 16		Pt 100 n° 17	
		VALORE MISURATO	ERRORE ASSOLUTO	VALORE MISURATO	ERRORE ASSOLUTO	VALORE MISURATO	ERRORE ASSOLUTO
		°C	°C	°C	°C	°C	°C
1	-69,9	-70,6	-0,7	-70,3	-0,4	-70,3	-0,4
2	-44,1	-45,1	-1,0	-44,8	-0,7	-44,7	-0,6
3	-29,1	-30,1	-1,0	-29,9	-0,8	-29,7	-0,6
4	-9,1	-10,2	-1,1	-9,9	-0,8	-9,6	-0,5
5	21,2	19,7	-1,5	20,0	-1,2	20,3	-0,9
6	31,2	29,6	-1,6	29,9	-1,3	30,3	-0,9
7	51,2	49,6	-1,6	49,9	-1,3	50,3	-0,9
8	81,3	79,5	-1,8	79,9	-1,4	80,2	-1,1
9	101,5	99,5	-2,0	99,9	-1,6	100,3	-1,2
10	121,4	119,4	-2,0	119,7	-1,7	120,2	-1,2

N°	VALORE DI RIFERIMENTO °C	Pt 100 n° 18		Pt 100 n° 19	
		VALORE MISURATO	ERRORE ASSOLUTO	VALORE MISURATO	ERRORE ASSOLUTO
		°C	°C	°C	°C
1	-69,9	-70,4	-0,5	-70,3	-0,4
2	-44,1	-44,9	-0,8	-44,9	-0,8
3	-29,1	-29,8	-0,7	-29,9	-0,8
4	-9,1	-9,8	-0,7	-9,9	-0,8
5	21,2	20,2	-1,0	20,1	-1,1
6	31,2	30,1	-1,1	29,9	-1,3
7	51,2	50,2	-1,0	50,0	-1,2
8	81,3	80,1	-1,2	80,0	-1,3
9	101,5	100,2	-1,3	100,0	-1,5
10	121,4	120,1	-1,3	119,9	-1,5

Errore assoluto = valore misurato - valore di riferimento

OPERATORE



Campioni di riferimento e apparecchiature

- Termometro digitale campione, lettore Scan-P-M-CI s/n S2853-5191 (matr. int. 02T), sensore Pt100/4 Giussani s/n E03P896 (matr. int. 34T)(1^a linea)

Sintesi della procedura di misura applicata

La taratura è stata effettuata per confronto con termometro campione a resistenza di platino, con le sonde inserite nel simulatore spaziale quale sorgente di calore. I sensori in verifica sono stati collegati, per la lettura dei valori, al computer. L'elaborazione dei dati sperimentali è stata effettuata applicando la formula riportata in calce alla tabella di presentazione dei risultati.

Incertezza stimata relativa alla procedura applicata

Le incertezze, simmetriche in più ed in meno, associate ai valori di riferimento riportati nel presente rapporto, sono calcolate con un fattore di copertura $k=2$, corrispondente ad un livello di confidenza di circa 95% e sono minori di 0,2°C per valori negativi di temperatura, 0,11°C tra 0°C e 200°C, 0,25°C tra 200°C e 400°C, 0,45°C oltre. Il contributo dello strumento in verifica è stimato in ± 1 digit se digitale, o $\pm 1/2$ di divisione se analogico.

Note

I risultati della taratura con le relative incertezze valgono con lo strumento in verifica nelle condizioni in cui è stato tarato.

OPERATORE

